Original Article

Study of Dexmedetomidine and Magnesium Sulphate in Attenuation of Hemodynamic Responses During Tracheal Extubation

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Abstract

Background: Laryngoscopy and tracheal intubation in adults are commonly associated with increase in arterial BP and HR. the objective is to observe the hemodynamic responses during tracheal extubation. **Material and Methods:** Following the endorsement of the Institutional Ethical Committee and the acquisition of written informed consent from the participants, this study was executed on 60 patients of both genders classified as ASA I and II, aged 20 to 50 years, who were slated for elective laparoscopic cholecystectomy under general anesthesia, and were randomly divided into two groups, group D and group M (30 in each). Patients in Group D were administered 0.7 mcg/kg of Dexmedetomidine diluted in 100 ml of Normal Saline (0.9% sodium chloride) over a span of 10 minutes during the closure of the port site skin. **Results:** The heart rate during and post-extubation in the Dexmedetomidine cohort was more effectively regulated than in the Magnesium sulfate cohort. The Dexmedetomidine cohort exhibited superior management of systolic blood pressure relative to the MgSO4 cohort during and post-extubation [P value less than 0.01], indicating statistical significance. The Dexmedetomidine cohort had a reduced occurrence of elevated diastolic blood pressure in comparison to the MgSO4 group during and following extubation. **Conclusion:** Dexmedetomidine given at a dosage of 0.7 mcg/kg body weight prior to tracheal extubation proved to be more efficient in preserving hemodynamic stability.

Keywords: hemodynamic stability. Extubation; Dexmedetomidine; Magnesium Sulphat.

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Introduction

The majority of myocardial ischemia episodes transpire during the processes of intubation and extubation. These ischemic events are causally linked to postoperative myocardial infarction.

Elevations in heart rate and arterial blood pressure at the conclusion of anesthesia and immediately following endotracheal extubation may lead to a perilous surge in myocardial oxygen demand akin to that observed during intubation in those with coronary artery disease.[1,2]

Tracheal intubation is generally linked to heightened heart rate and blood pressure, while tracheal extubation is more intricate due to further hemodynamic responses to discomfort upon awakening from anesthesia. In addition, interrupted vascular suture lines, raised intraocular pressure, and augmented intracranial pressure possess the capacity to exacerbate morbidities. The incidence of respiratory difficulties post-tracheal extubation is three times greater than that of issues during tracheal intubation and the initiation of anesthesia (4.6% versus 12.6%).[3]

In laparoscopic cholecystectomy, initial Trendelenberg position, creation of carbo-peritoneum, systemic absorption of CO2 and reverse Trendelenberg position cause patho-physiological changes in various systems of the body leading to increase in plasma levels of nor epinephrine, epinephrine and plasma renin activity.[4]

Protection against the hemodynamic responses of extubation is required to avoid its complications. Numerous contemporary strategies to mitigate the extubation response encompass: enhanced levels of anesthesia, administration of intravenous local anesthetics (lignocaine), calcium channel antagonists (verapamil, nicardipine), opioids (fentanyl and alfentanil), and sympathetic inhibitors (beta blockers, alpha 2 agonists) such as clonidine, dexmedetomidine, and magnesium sulfate.

With this background, this study was conceptualized to analyse the outcome of dexmedetomidine with that of intravenous Magnesium sulphate on the hemodynamics during endotracheal extubation.

Materials and Methods

The planned study is a double-blind trial done in the Anesthesiology Department of Adichunchanagiri Institute of Medical Sciences and Research Center, B.G. Nagara, Mandya

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District, between January 2019 and June 2020, authorized by the ethical council of the institute.
The study involved data from 60 adult patients of either sex, gathered in a randomized prospective approach during elective laparoscopic cholecystectomy procedures.

Inclusion criteria:
- Written informed consent
- The patients of both sexes with the age group from 20 to 50 years.
- ASA Grade 1 and Grade II
- Study group consisted of 60patients scheduled for Laparoscopic cholecystectomy procedure under general anaesthesia.

Exclusion criteria:
- Patients refusal
- Patients aged <20yrs, >50yrs
- ASA physical status III and IV
- Emergency surgical interventions.

Individuals with notable systemic disorders, ischemic heart disease, hypertensive heart conditions, diabetes mellitus, bronchial asthma, a history of myocardial infarction, known drug allergies, cerebrovascular insufficiency, co-morbidities, or those who smoke will be omitted from the study. A total of sixty patients, aged between 20 and 50 years, of both sexes, who were set to undergo elective laparoscopic cholecystectomy and categorized as ASA Grade I and ASA Grade II, participated in the study. The participant population was categorized into two groups, with 30 patients in each.
- Group D - The patients received 0.7mcg/kg of Inj Dexmedetomidine in 100ml Normal Saline[0.9% sodium chloride]Over 10 minutes duration at the time of port site skin closure (n=30)
- Group M-The patients received 30mg/kg of Inj magnesium sulphate in 100ml Normal Saline[0.9% sodium chloride]Over 10 minutes duration at the time of port site skin closure (n=30)

The pre-anaesthetic assessment was conducted on the nite before to the operation following the acquisition of informed written consent. A standard pre-anaesthetic evaluation was performed, examining.
- The patient's overall health
- The patient's height, weight, and nutritional status.
- A thorough analysis of the respiratory, cardiovascular, central nervous, renal, and hepatic systems, among other essential organ systems. The aforementioned criteria were noted as follows.
- Following surgery, which acts as a baseline.
- When the study medication is administered.
- Three and five minutes after the study medication is administered.
- During the extubation process
- One, three, five, ten, and fifteen minutes after extubation.

Tachycardia was defined as a 20% rise in heart rate from baseline, hypertension as a 20% increase from baseline or SBP >160 mmHg, and hypotension as a 20% drop from baseline or SBP <80 mmHg. Bradycardia was defined as HR <50/min and was treated with an intravenous injection of atropine (0.6 mg).
The following parameters were compared.
How long does extubation take to manifest?
- Extubation quality was assessed using a five-point rating system: 1] No cough, smooth extubation

3] Moderate coughing [three to four times] 2] Easy extubation, little coughing [one to two times]
4] Prolonged coughing [5–10 times]

Sample Size Estimation:
Based on preliminary pilot research observations, the sample size was determined in consultation with the statistician. It was determined that each group should include about 23 patients to guaranty a power of 0.80.
The ultimate sample size was determined to be 30 patients in each group, assuming a 5% dropout rate. This would allow for a type 1 alpha error of 0.05 and a type 2 error of beta = 0.2.
It was calculated using following formula:
n= 2 {Z (1-a/2) + Z (1-b)} 2 / D2
Where,
Z (1-a/2) is the alpha error.
Z (1-b) is the beta error or power of the study. D=difference in mean/ S.D.
Statistical analysis: SPSS 22 version software was used to evaluate the data after it was entered into a Microsoft Excel data sheet. Frequencies and proportions were used to show categorical data. The significance test for qualitative data was either the chi-square test or Fischer's exact test (for 2x2 tables only). The mean and standard deviation were used to depict continuous data. To determine the mean difference between two quantitative variables, the independent t test was utilized as a measure of significance. Data visualization: Several kinds of graphs were created using Microsoft Word and Excel. Following the assumption of all statistical test principles, a P value (Probability that the result is true) of less than 0.05 was deemed statistically significant.

RESULTS

No statistically significant disparity was seen between the two groups regarding sex distribution.
In group D, the average age was 36.10 years with a standard deviation of 10 years. In group M, the average age was 35.13 years with a standard deviation of 9.09 years.
The P value was 0. 697.No statistically significant disparity was seen between the two groups concerning age distribution. In Group D90% of the subjects had Cholelithiasis and 10% of the subjects had GB polyp. In Group M 93.3% of the subjects had Cholelithiasis and 6.7% of the subjects had GB polyp. The P Value was 0.640, indicating no statistically significant disparity between the two groups concerning pre-operative diagnosis.
The P value was recorded as 0.07. No statistically significant disparity was seen between the two groups concerning weight.

Table 1: Comparison of mean Heart rate at various time interval between two groups

Heart rate	Group D		Group M		P value
	Mean	SD	Mean	SD	
Baseline	91.13	6.57	90.43	4.42	0.630
0 min	90.27	5.02	90.13	3.95	0.909
3min after administration of study drug	86.93	4.83	89.30	3.89	0.041
5min after administration of study drug	82.43	4.66	88.83	2.89	<0.01
At time of extubation	82.67	4.07	88.90	3.03	<0.01
0 min	82.67	4.07	88.90	3.03	<0.01
1 min	84.60	3.78	89.30	3.89	<0.01
3 min	83.87	3.60	86.87	1.68	<0.01
5 min	84.60	3.78	87.07	2.18	<0.01
10 min	82.67	4.07	85.60	3.09	<0.01
15 min	84.60	3.78	89.23	3.86	<0.01

A statistically significant disparity was observed between the two groups concerning heart rate at 3 minutes post-administration of the study drug, with a P value of 0.041; at 5 minutes post-administration, the P value was below 0.01. At the time of extubation and subsequently at 0, 1, 3, 5, 10, and 15 minutes, the P values were all less than 0.01, indicating statistical significance. Group D had a notable reduction in heart rate relative to group M.

A statistically significant disparity was observed between group D and group M concerning systolic blood pressure. At 5 minutes post-drug administration, the P value was 0.011; at extubation, it was below 0.01. After extubation, at both 0 and 1 minute, the P value was less than 0.01, while at 5 minutes it was 0.023, and at 10 and 15 minutes, it remained below 0.01, indicating statistical significance. Group D had a notable reduction in systolic blood pressure in contrast to group M.

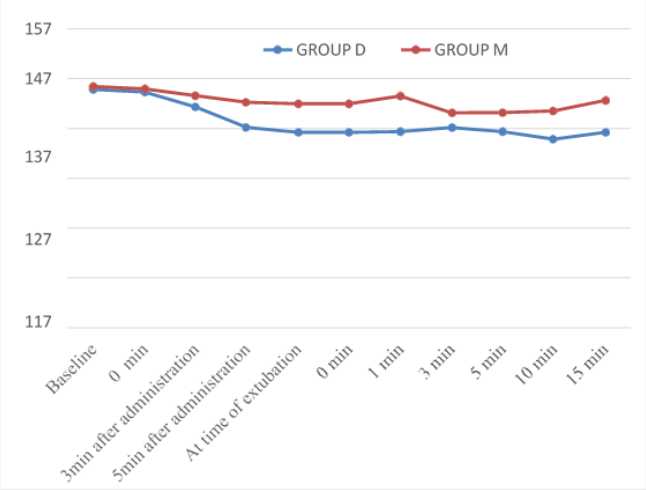

Figure 1: Graph showing Comparison of mean Systolic blood pressure (SBP)

There was a statistically significant difference found between group D and group M with respect to Diastolic blood pressure. At5min after administration of drug the P value was less than 0.01, At time of extubation P value was less than 0.01, after extubation at 0min and 1min P value was less than 0.01, at 3min P value was 0.033, at 5min P value was less than 0.01, at 10min P value was less than 0.01, at 15min P value was less than 0.01, which were all statistically significant, with group D showing significant decrease in mean Diastolic pressure when compared to group M.

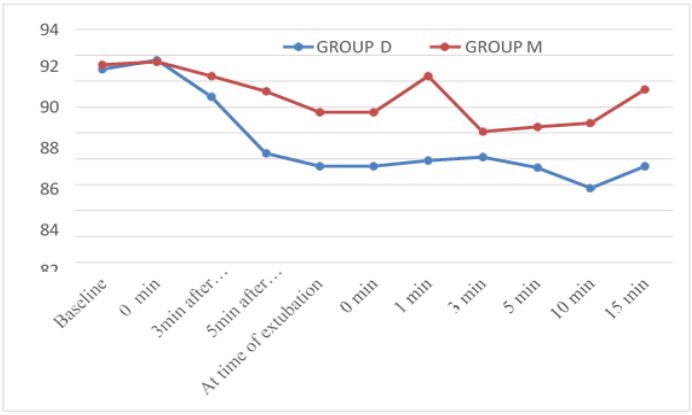

Figure 2: Graph showing Comparison of mean DBP at various time interval between two groups .

There was a statistically significant difference found between two group with respect to Mean arterial pressure (MAP). At 5min after administration of study drug P value was less than 0.01, At time of extubation P value was less than 0.01, after extubation at 0min and 1min P value was less than 0.01, at 3min P value was 0.046, at 5min P value wasless than 0.01,at 10min P value was less than 0.01,at 15min P value was less than 0.01, which were all statistically significant. Group D showing significant decrease in Mean arterial pressure compared to that of Group M.

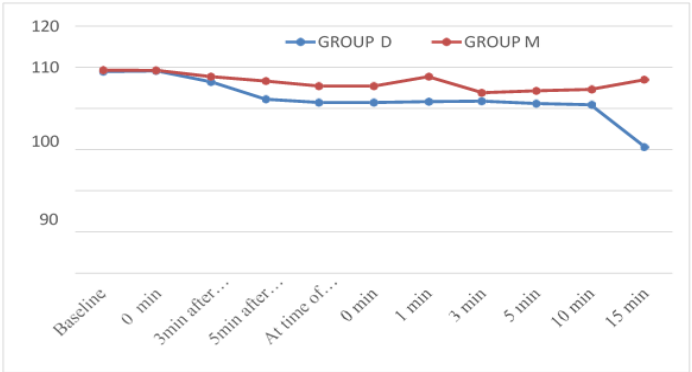

Figure 3: Graph showing Comparison of mean MAP at various time interval

The results were statistically not significant between two group in regards to oxygen saturation.

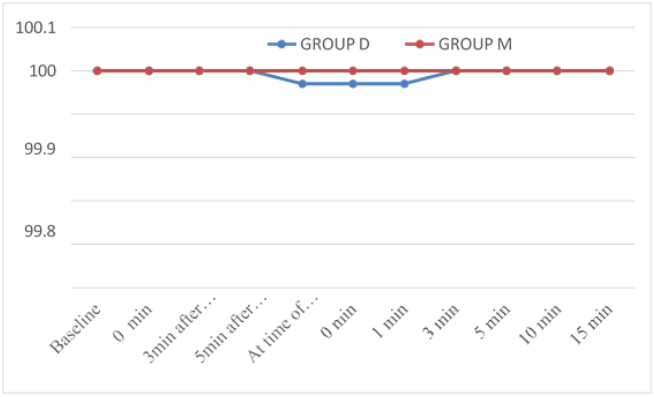

Figure 4: Comparison of mean oxygen saturation (SPO2) at various time interval between two group

Discussion

The removal of the tracheal tube is linked to significant variations in hemodynamics that may result in tachycardia, hypertension, and arrhythmias. It is likewise linked to heightened reflexive airway responsiveness, resulting in stress responses and airway discomfort.

The differences in heart rate between Dexmedetomidine and Magnesium Sulfate were statistically significant, with a P value of 0.041 at 3 minutes post-administration, and less than 0.01 at 5 minutes. At extubation and subsequent intervals of 0, 1, 3, 5, 10, and 15 minutes, the P values were all below 0.01, indicating statistical significance. Group D had a notable reduction in heart rate from baseline in contrast to group M.

This is in conjunction with observation done by Zarif P et al,[5] and CHAITANYA K, et al.[6], who observed that HR records were significantly lower in groups receiving Dexmedetomidine compared to group receiving Magnesium Sulphate with P value being less than 0.01.

In our investigation, we noted that the variations in systolic blood pressure between Dexmedetomidine and Magnesium Sulfate were statistically significant, with a P value of 0.011 from the fifth minute post-administration of the study drug. At extubation, the P value was below 0.01, and at 0 and 1 minute after extubation, the P value remained below 0.01; 5 minutes post-extubation, the P value was 0.023, while at 10 and 15 minutes post-extubation, the P values were both below 0.01, indicating statistical significance.

This is in conjunction with the observation done by Bhadrala N And Gupta M,[7] who observed that On comparing Magnesium sulphategroup with Dexmedetomidine group, significant difference ($p<0.01$) in SBP was observed at all the time intervals after drug administration, post extubation.

In our study, we observed that the diastolic blood pressure variations between Dexmedetomidine and Magnesium Sulphate were statistically significant from 5thminute of administration of drug with P value being <0.01,At time of extubation P value was less than 0.01, after extubation at 0min and 1min P value was less than 0.01, at 3min P value was 0.033, at 5min P value was less than 0.01 ,at 10min P value was less than 0.01, at 15min P value was less than 0.01, which were all statistically significant, with group D showing significant decrease in mean Diastolic pressure with respect to its baseline values when compared to group M.

The findings are concurrent with the study conducted by VUDITHE K, et al,[8] who observed that diastolic blood pressure were significantly decreased in group receiving Dexmedetomidine than group receiving Magnesium Sulphate with P value being less than 0.05.

In our study, we observed that Dexmedetomidine had a better control over mean arterial pressure as compared to that of Magnesium Sulphate and it remained statistically significant from the 5th minute of administration of drug with P value being less than 0.01, At time of extubation P value was less than 0.01, after extubation at 0min and 1min P value was less than 0.01 ,at 3min P value was 0.046 ,at 5min P value was less than 0.01,at 10min P value was less than 0.01,at 15min P value was less than 0.01, which were all statistically significant. Dexmedetomidine Group showed significant decrease in Mean arterial pressure compared to that of Magnesium sulphate Group.

So, the findings are similar to the study conducted by Bhadrala N and Gupta M,[7] who observed that MAP values difference were more when compared the Dexmedetomidine group with ($p<0.001$), that of Magnesium sulphate group.

Conclusion

The heart rate during and post-extubation in the Dexmedetomidine cohort was more effectively regulated than in the Magnesium sulfate cohort, beginning three minutes after the administration of the study medication, with a P value of 0.041, indicating statistical significance.

The Dexmedetomidine cohort exhibited superior regulation of systolic blood pressure relative to the MgSO4 cohort during and subsequent to extubation [P value less than 0.01], with statistical significance commencing at the 5th minute post-administration of the study drug, where the P value was 0.011, and persisting thru 1, 3, 5, 10, and 15 minutes following extubation.

The Dexmedetomidine cohort exhibited a reduced occurrence of elevated diastolic blood pressure in comparison to the MgSO4 cohort during and following extubation, which was statistically significant with a P value of less than 0.01, commencing from the 5th minute post-administration of the study drug with a P value of 0.011, and persisted at 1, 3, 5, 10, and 15 minutes post-extubation.

During the initial minute to the fifteenth minute post-extubation, the dexmedetomidine cohort had a reduced occurrence of elevated mean arterial pressure relative to the MgSO4 group, with a P value below 0.01, indicating statistical significance.

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